Patent Filing: Structural Scientific Validator Stack for Pre-Review Integrity Assessment

Title

System and Method for Structural Integrity Validation of Scientific Manuscripts Prior to Peer Review

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Abstract

A system and method are disclosed for evaluating the structural integrity of scientific manuscripts prior to peer review, reputation assessment, or semantic evaluation. The invention defines a modular validator stack composed of deterministic, non-semantic integrity gates that assess the internal construction of a manuscript rather than the truth or novelty of its claims. The system detects structural incoherence, reasoning discontinuities, method–claim misalignment, inquiry drift, and epistemic misuse of citations. Outputs consist of diagnostic structural signals intended to assist editors, publishers, and auditors in filtering manuscripts at scale without performing content moderation, fact checking, or accept/reject judgments. The approach enables early detection of AI-generated manuscripts, paper-mill outputs, and structurally fraudulent papers while remaining model-agnostic and neutral with respect to scientific claims.

Field of the Invention

The present invention relates to scientific publishing infrastructure, document validation systems, and automated manuscript assessment. More specifically, it relates to pre-review integrity analysis of scientific manuscripts based on structural properties rather than linguistic fluency, author identity, citation counts, or semantic correctness.

Background

Scientific publishing systems are experiencing systemic strain due to a rapid increase in manuscript volume, including submissions generated or augmented by large language models, paper mills, and automated writing tools. Traditional safeguards—peer review, editorial screening, plagiarism detection, and post-publication retraction—operate downstream of submission and rely heavily on human labor, reputation heuristics, and semantic surface features.

These mechanisms increasingly fail to detect structurally incoherent manuscripts that nonetheless appear fluent, formally formatted, and citation-heavy. In particular:

- AI-generated manuscripts may exhibit high linguistic quality while lacking coherent argumentative structure.
- Paper-mill outputs may mimic scientific form while decoupling methods from claims.
- Fabricated or laundered citations may function as authority signals rather than evidentiary support.

Existing tools focus on content similarity, language quality, citation presence, or metadata signals. None evaluate whether a manuscript is *structurally capable* of supporting its own claims. As a result, structurally unsound papers routinely pass initial screening and impose unsustainable burdens on peer review systems.

There is therefore a need for a pre-review system that evaluates *how* a manuscript is built, not *what* it claims.

Summary of the Invention

The invention provides a **Structural Scientific Validator Stack** comprising a set of independent integrity gates that evaluate manuscripts based on structural coherence rather than semantic correctness.

Key characteristics of the invention include:

- **Pre-review operation**: The system operates before peer review, reputation analysis, or editorial decision-making.
- **Non-semantic evaluation**: The system does not assess truth, correctness, novelty, or factual accuracy.
- **Deterministic gates**: Each integrity check produces stable, repeatable outputs.

- **Non-corrective diagnostics**: The system does not rewrite, improve, or alter manuscripts.

- **Model-agnostic architecture**: The system is independent of any specific AI model or generation method.

The validator stack produces structural diagnostics intended to inform editorial workflows, risk assessment, and audit decisions.

System Architecture Overview

The validator stack comprises multiple independent integrity gates. Each gate analyzes a distinct structural dimension of a manuscript. Gates may operate sequentially or in parallel.

Core Gates

1. Reasoning Structure Check

This gate evaluates the continuity and integrity of argumentative flow across the manuscript.

Detected failure modes include, but are not limited to:

- Non-sequitur transitions between sections

- Collapsed reasoning chains (e.g., method → result discontinuity)

- Assertions unsupported by prior reasoning steps

- Structural loops or rhetorical padding

The gate does not assess whether reasoning is *correct*, only whether it is *structurally continuous*.

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2. Core Inquiry Continuity Check

This gate verifies that the research question or inquiry introduced at the beginning of the manuscript remains intact throughout.

Detected failure modes include:

- Topic drift across sections
- Substitution of the original inquiry with an adjacent or broader claim
- Conclusions that no longer correspond to the stated research question

This gate evaluates inquiry persistence, not research quality.

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3. Method–Claim Logic Consistency Check

This gate assesses whether the described methods are structurally capable of supporting the scope and nature of the manuscript's claims.

Detected failure modes include:

- Claims exceeding the methodological resolution described
- Results sections introducing outcomes not derivable from stated methods
- Method descriptions that function as placeholders rather than operative constraints

The gate does not judge experimental validity, only method–claim alignment.

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4. Epistemic Trace Check

This gate examines how citations function within the manuscript.

Detected failure modes include:

- Citations used as authority decoration rather than evidence
- References that do not causally support adjacent claims
- Citation clusters replacing missing reasoning steps
- Epistemic laundering patterns where sources obscure rather than clarify justification

This gate does not assess citation prestige, impact, or correctness.

Operational Characteristics

Each integrity gate:

- Operates independently
- Produces deterministic outputs
- Requires no training on proprietary corpora
- Avoids semantic interpretation of claims
- Produces structural diagnostics rather than binary judgments

The system may output:

- Pass indicators
- Structural warnings
- Integrity risk signals
- Section-level diagnostic annotations

Output Philosophy

The system explicitly avoids:

- Accept/reject decisions
- Truth evaluation
- Content moderation
- Author attribution or intent inference

Outputs are designed for:

- Editors
- Publishers
- Research integrity officers
- Auditors

The system functions as an **instrument panel**, not an arbiter.

Use Cases

Non-limiting examples include:

- Pre-review manuscript filtering
- Editorial triage at scale
- Detection of AI-generated or paper-mill manuscripts
- Risk scoring for peer review allocation
- Integrity audits of submission pipelines
- Research integrity monitoring

Advantages Over Prior Art

The invention differs from existing systems by:

- Evaluating structure instead of language fluency
- Remaining neutral to scientific claims
- Operating upstream of peer review
- Scaling without human interpretation

- Detecting AI misuse without banning AI
- Avoiding post-hoc retraction dependence

Non-Limiting Implementation Notes

The invention may be implemented using:

- Rule-based systems
- Symbolic analysis
- Structural graph analysis
- Deterministic agent pipelines
- Hybrid human–machine workflows

Specific heuristics, thresholds, or scoring mechanisms are intentionally omitted to preserve adaptability and integrity.

Conclusion

The Structural Scientific Validator Stack establishes a new category of scientific publishing infrastructure: pre-review structural integrity assessment. By evaluating how manuscripts are built rather than what they claim, the system enables scalable, neutral, and defensible filtering of scientific submissions in an era of AI-assisted authorship and publication overload.

Claim Scope

This disclosure establishes priority over any system that:

1. Evaluates scientific manuscripts prior to peer review

2. Assesses structural coherence rather than semantic correctness

3. Uses modular integrity gates addressing reasoning, inquiry, method–claim alignment, or epistemic trace

4. Produces diagnostic outputs without accept/reject decisions